tion for people at high risk for infection. These include health care workers in regular contact with blood or body fluids, especially surgeons, pathologists, oral surgeons, dentists and hygienists; operating room, intensive care unit, hemodialysis unit and emergency room staff, and hematology and blood bank technicians and phlebotomists. Other high-risk groups include sexually promiscuous populations (especially homosexual men), intravenous drug users, hemodialysis patients, residents and staff of mental institutions, prisoners and residents of viral hepatitis type B endemic regions. It is recommended that the HBV vaccine be given to household and intimate contacts of acutely infected persons. Recommended postexposure prophylaxis for known exposure to viral hepatitis type B has recently been modified such that the vaccine should be given along with an initial dose of hepatitis B immune globulin (HBIG) (at a separate site) to patients at risk; subsequent doses of the vaccine are given at one and six months, while the usual second dose of HBIG is no longer required. A booster of vaccine is recommended after five years. The vaccine can also be given to neonates whose mothers are HBsAg-positive; the risk to the fetus should be negligible. Pregnancy should not be considered a contraindication for vaccination for women at risk.

No serious side effects related to the vaccine have appeared in more than 200,000 recipients since testing began. Pain at the injection site and low-grade fever have been the only side effects noted in controlled trials of HBV vaccine. No cases of hepatitis B or non-A, non-B hepatitis have developed from vaccination. Similarly, there is no evidence that *any* cases of acquired immunodeficiency syndrome (AIDS) have been caused by vaccine administration, and, indeed, the incidence of AIDS is less in vaccine trial recipients (composed of patients at high risk for AIDS) than in matched controls who received placebo.

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Nonoperative Management of Fingertip Amputations

NONOPERATIVE MANAGEMENT of fingertip amputations has been described in the literature for more than ten years and has now become a generally accepted alternative to surgical repair. Nonoperative treatment—allowing a fingertip to heal by secondary intention—has achieved cosmetic and functional results that are consistently superior to split-thickness grafting techniques. Local flaps such as the Kutler V-Y flap, crossed-finger flaps and volar-advancement flaps offer early coverage of a finger, but the complication rate and long-term results are poorer than with nonoperative management. Superior results have occurred in prospective trials in which the wound was allowed to heal secondarily.

Nonoperative management provides the further advantage of preserving maximum finger length by removing the necessity in most cases of rongeuring back the exposed bone to provide skin coverage surgically. Nevertheless, some patients who need skin coverage to return to work may elect a surgical procedure, even if some further shortening of the finger is required.

The technique of nonoperative treatment involves debridement of nonvital soft tissue only, followed by an occlusive dressing (antibiotic, petrolatum gauze, gauze bandage) for 48 hours. Warm-tap-water soaking four times a day for 10 to 15 minutes is then instituted. The wound may be covered with two plastic bandages between soakings (one over the end of the finger, and the other around the first to keep it in place). The wound heals in two to three weeks in cases of pulp amputation and four to eight weeks in cases of more extensive injury involving exposed or protruding bone. In many cases, the patient can return to work in two to three days with a protective splint, if needed. Frequent bandage changes and soaking serve to remove any exudate and debris. The prophylactic use of antibiotics is generally not necessary except in grossly contaminated wounds. Joint stiffness can be prevented by active range of motion of all finger joints during soaking.

Healing occurs as soft tissue migrates over any exposed bone and is covered by the advancing epithelial margin. The result is a fingertip with normal epithelium except for a small linear scar. Amputation neuromas rarely, if ever, occur. Sensation is generally excellent, as is cosmetic appearance. Most complications are related to nail deformity, which most often occurs when a significant portion of the bone under the nail bed has been lost. Such deformities may be eliminated by removing the nail matrix entirely (either at the time of injury or at a later date) if a patient so desires.

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The Use of Activated Charcoal in Cases of Poisoning and Drug Overdose

ACTIVATED CHARCOAL is widely used in treating cases of poisoning and drug overdose. A finely powdered product of the pyrolysis of wood pulp, the charcoal is "activated" by exposure to oxidizing gas at high temperatures to make a network of tiny pores. The total surface area of these pores is about 1,000 m^2 per gram of charcoal. Activated charcoal binds a variety of drugs and chemicals and thus may prevent their absorption from the gastrointestinal tract. The effectiveness of charcoal in preventing poisoning was shown by a French pharmacist in 1831 when he swallowed a lethal dose of strychnine along with 15 grams of charcoal without ill effect.

Charcoal (50 to 100 grams) is routinely given to poisoning victims after emptying the stomach with ipecac-induced emesis or gastric lavage. Unfortunately, persistent emesis after ipecac is given often delays the administration of charcoal for as long as two to three hours. Because charcoal

effectively binds many toxins, it has been suggested that simple administration of charcoal may eventually supplant ipecac-induced emesis in most poisoning victims. In fact, a recent study showed that the use of oral charcoal alone was superior to ipecac-induced emesis. Volunteers who ingested 2 grams of aspirin absorbed significantly less salicylate when treated only with activated charcoal compared with those who were given only ipecac. A third group treated with ipecac then charcoal showed aspirin absorption similar to the ipecac-only group. This was apparently because only two of ten receiving ipecac then charcoal were able to retain the charcoal due to persistent vomiting. Further studies will be needed before charcoal replaces emesis in routine poisoning management. Charcoal does not effectively bind some toxins, such as iron and probably alcohols. Also, the use of charcoal remains controversial in a case of acetaminophen ingestion when oral administration of the antidote, *N*-acetylcysteine, is contemplated.

Recently, interest has focused on the use of repeated doses of charcoal (15 to 20 grams every three to four hours) to enhance the elimination of some drugs and poisons. This may occur by interrupting enterohepatic or enteroenteric recirculation. A 50% reduction of the serum half-life of theophylline and phenobarbital has been recently found in volunteers given repeat-dose charcoal. To prove that orally administered repeat-dose charcoal does not simply bind unabsorbed ingested drug, Berg and co-workers gave volunteers phenobarbital intravenously and found the same reduction in serum half-life. This increased nonrenal elimination is thought to be due to a "back-diffusion" of drug across the intestinal villi to the intraluminal charcoal, resulting in what has been described as "gastrointestinal dialysis." A similar reduction in serum half-life with repeated-dose charcoal has been shown in patients overdosed on theophylline and phenobarbital. However, whether this has practical clinical benefit remains unknown. In a randomized study of phenobarbital overdose, for example, patients receiving repeated-dose charcoal awoke and were extubated no sooner than those getting a single dose of charcoal, even though the drug's elimination half-life was much shorter.

These findings are applicable to the management of poisoned patients. Orally administered activated charcoal remains a fundamental adjunctive therapy for gastrointestinal decontamination. It may eventually replace the use of ipecac as the best single treatment for a variety of ingestions. The contribution of the use of cathartics, emesis or lavage to gut decontamination remains unclear but each continues to be widely used. Repeated-dose charcoal enhances the elimination of several drugs and is currently recommended for overdoses of digitoxin, phenobarbital or theophylline.

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Large-Volume Fluid Resuscitation

THE TRADITIONAL APPROACH to resuscitating exsanguinating patients has called for multiple large-bore intravenous catheters. In the past five years the means to achieve higher flow rates and fewer intravenous (IV) sites have been reexamined.

Flow rates are linearly and inversely proportional to tube length, linearly proportional to pressure and logarithmically (to the fourth power!) proportional to the radius of the tube's lumen. These considerations have led to new intravenous strategies described herein.

The Seldinger (wire-guided) catheter, used in intensive care units, probably represents the single greatest advance. Using an 18-gauge needle, an obturator allows, with technical ease, step-up to an 8.5 French sheath. This sheath can be inserted into virtually any deep or superficial vein as long as it is not subject to bending (kinking or venous perforation may then occur). An experimental 14 French sheath with an internal diameter (ID) of 4.5 mm (French number divided by 3 equals the millimeter) has been used without adverse effect in the veins of dogs. Y sidearms are often a part of catheter sheaths. Though originally small bore, many are now manufactured with internal diameters to match the catheter sheath. This allows their successful use in volume resuscitation.

Because standard IV tubing for administering blood has an internal diameter of 3.2 mm, the tubing becomes a limiting factor when catheter sheaths much exceed 8.5 French (2.7 mm ID). Thus another strategy has been to increase tubing size. Though not yet commercially available, tubing of 6.4 mm ID has been tested in concert with an 8.5 French catheter sheath. Even though the internal diameter of this sheath (2.7 mm) is less than that of standard IV tubing (3.2 mm), flow was considerably enhanced by this system.

Another major advance has been the routine use of pressure infusion bags placed about the plastic IV bags. These simple, inexpensive and trouble-free devices safely increase infusion pressures to 300 mm of mercury. Their use increases flow rates two to three times over simple gravity flow. Experimentally, infusion pressures of 600 mm of mercury have been used in vitro. Current pressure infusion bags "red line" at 300 mm of mercury, though this cutoff point appears arbitrary.

Other innovations have been described. To accommodate the large flow through a 14 French catheter, a manifold fed by five IV systems has been described and operated successfully in dogs. The Bentley autotransfusion system has been used in concert with the 8F catheter sheath to produce flows two to four times those achievable by gravity alone.

The size of the vein cannulated is probably only rarely the limiting factor in flow rates, due to the considerable ability of veins to dilate. However, in an exsanguinated patient, the larger vein is clearly easier to cannulate. Thus use of the femoral vein has been described more often recently, with initially encouraging results. Removing vein size from consideration, a recent communication describes successful placement of the IV tubing directly into the right atrial appendage at open thoracotomy.